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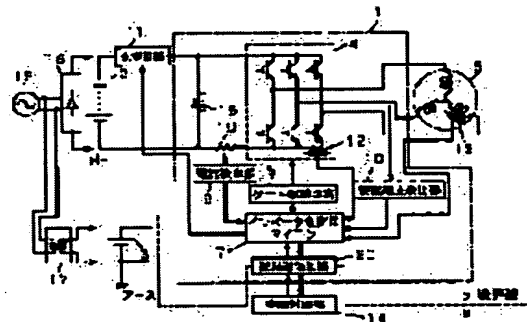
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## (54) AIR CONDITIONING INVERTER SYSTEM

### (57)Abstract:

PROBLEM TO BE SOLVED: To attain wire saving, miniaturization, lightening of weight, reduction of a cost, and reduction of an electromagnetic noise, in an air conditioning inverter system.

SOLUTION: A charge pump type gate drive circuit 9 operated in a power supply system (first power supply system) of a main battery 2, compressor temperature detection means 13 arranged on a motor winding, inverter controlling microcomputer 7, and an insulation communication circuit while insulated from an external air conditioning control part 14 to communicate, are provided. In this way, most part of an inverter system is operated by a single power supply system, an electromagnetic noise is reduced, a space and cost related to insulation between different power sources are reduced, and wiring can be also reduced.



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**CLAIMS**


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[Claim(s)]

[Claim 1] The electrically-driven compressor having the motor driven according to the first power source, and a compressor temperature detection means to detect the temperature of the coil part of the motor of said electrically-driven compressor in said first power system, The switching element group which transforms said first power source into the electrical potential difference for motorised [ said ] by the switching operation of two or more switching elements, Said switching element connected to either of the negative sides the forward side of said first power source The charge pump mold gate drive circuit driven using the power source which the current which flows to the switching element connected to a different polarity from the switching element concerned stored electricity, While outputting the control signal for turning on and turning off said switching element to said charge pump mold gate drive circuit and controlling said electrically-driven compressor The inverter system for air-conditioning equipped with the insulating communication circuit which communicates while insulating the control device of the inverter control section which operates in said first power system, and the exterior which operates with the secondary insulation power source generated from said inverter control section and said first power source.

[Claim 2] The electrically-driven compressor having the motor which it is carried in the car which has the first power source and second power source, and is driven according to said first power source, The switching element group which transforms said first power source into the electrical potential difference for motorised [ said ] by the switching operation of two or more switching elements, Said switching element connected to either of the negative sides the forward side of said first power source The charge pump mold gate drive circuit driven using the power source which the current which flows to the switching element connected to a different polarity from the switching element concerned stored electricity, While outputting the control signal for turning on and turning off said switching element to said charge pump mold gate drive circuit and controlling said electrically-driven compressor The inverter system for air-conditioning equipped with the insulating communication circuit which communicates while insulating the control device of the inverter control section which operates in said first power system, and the exterior which operates in said inverter control section and said second power system.

[Claim 3] The inverter system for air-conditioning according to claim 2 which established a compressor temperature detection means to detect the temperature of the coil part of the motor of an electrically-driven compressor in the first power system.

[Claim 4] The inverter system for air-conditioning according to claim 2 or 3 with which the first power source and second power source are insulated.

[Claim 5] The inverter system for air-conditioning according to claim 2 or 3 by which the first power source and second power source are insulated, and the second power source is grounded to the car case.

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the inverter system for air-conditioning which drives an electrically-driven compressor.

[0002]

[Description of the Prior Art] This conventional kind of inverter system for air-conditioning has a thing as shown in drawing 10. This drawing 10 is what showed the electrical diagram of the system carried in the electric vehicle, and inverter equipment 1' has received supply of a power source from two lines, the main cell 2 of an electric vehicle, and the auxiliary cell 3. The main cell 2 usually mainly serves as a power source of the drive system of large power on the about [ 250V ] electrical potential difference, and serves as a power source of the electrically-driven compressor 5 for air-conditioning through the switching element group 4, and also it has become the power source of the motor for automobile transit. moreover -- and also the auxiliary cell 3 usually serves as a power source of the control system of inverter equipment 1' on the about [ 12V ] electrical potential difference -- a head lamp, a fan motor, a wiper, etc. -- comparatively -- small -- it is also the power source of a power load. And in the electric vehicle or the hybrid car, the main cell 2 and the auxiliary cell 3 are insulated, and the negative terminal of the auxiliary cell 3 is usually grounded to the car case.

[0003] the inverter equipment 1 of drawing 10 -- they are 'the circuit by the side of a of the boundary line which showed the circuit which is operating in response to supply of 12V power source from the auxiliary cell 3 inside by \*\*\*\*\*, i.e., current detecting-element 8', gate drive circuit 9', inverter temperature detection means 12', the induced voltage detecting element 10', inverter control-oriented-microcomputer 7', etc. A power circuit 6 is a circuit which creates 5V power source which turns into a power source of a microcomputer or various kinds IC based on 12V power source. Moreover, 12V power source from the auxiliary cell 3 is also the power source of charge circuit 11' or compressor temperature detection means 13' in the exterior of inverter equipment 1'.

[0004] Here, each element which was mentioned above and with which the boundary line overlaps on drawing 10 like charge circuit 11' is a circuit which is operating by the electrical power system from [ both ] a power source [ low battery / from the high voltage power source and the auxiliary cell 3 from the main cell 2 ]. Here, the word an electrical power system or "power system" is defined as "a power-source environment including a certain primary power source and the power source connected to one of the positive/negative."

[0005] Next, the air-conditioning control section 14 was operating in 12V electrical power system, determined the request engine speed of an electrically-driven compressor 5 based on information, such as various sensors, such as whenever [ room air temperature ], and crew's temperature set point, and has transmitted to inverter equipment 1' as a command value. And in response to this command value, inverter control-oriented-microcomputer 7' emits a gate control signal to gate drive circuit 9' so that an electrically-driven compressor 5 may become a command engine speed, and it controls ON of each IGBT of the switching element group 4, and OFF. The wave outputted to an electrically-driven

compressor 5 here is the PWM electrical potential difference of a three phase.

[0006] In addition, as an example of the above mentioned conventional inverter system, there is a thing as JP,8-48140,A indicated to be.

[0007] Drawing 11 is drawing having shown the configuration of the printed circuit board of this conventional inverter equipment 1', and is bisected from the main cell to the first electrical power system circuit and from an auxiliary cell to the second electrical power system circuit. Moreover, drawing 12 shows the example of loading to an electric vehicle.

[0008] Next, the inverter system of the conventional home air conditioner is explained using drawing 10. In the case of the home air conditioner, the power source is supplied from the source power supply 15 of single phase 100V grade, and it is only this source power supply 15 as a primary power source. And as a drive power source of a compressor, the DC power supply which rectified it with rectifier diode 16 are too supplied to the electrically-driven compressor 5 through the switching element group 4.

[0009] Next, as a power source to a control system, the secondary insulation direct current voltage which decompressed and insulated the source power supply 15 by the isolation transformer 17 is supplied as a power source of inverter control-oriented-microcomputer 7' or air-conditioning control-section 14 grade. Although the power circuit using this isolation transformer 17 has not carried out illustration, it is usually incorporated in inverter equipment 1'. moreover -- a current -- a detecting element -- eight -- ' -- the gate -- a drive -- a circuit -- nine -- ' -- induced voltage -- a detecting element -- ten -- ' -- having mentioned above -- an electric vehicle -- \*\* -- a case -- the same -- the high voltage -- a drive system -- a power source -- the -- a drive system -- a power source -- from -- insulating -- having had -- a low battery -- a power source (secondary insulation DC power supply) -- from -- both -- an electrical power system -- operating -- \*\*\*\* -- a circuit -- it is .

[0010]

[Problem(s) to be Solved by the Invention] However, the technical problem as shown below occurred in the above-mentioned conventional inverter system.

[0011] In the first place, two power sources needed to be drawn in inverter equipment 1', and the technical problem that wiring increased in number was.

[0012] Since two insulations have drawn the required power source in the second in inverter equipment 1' Between each circuit which is operating with each power source (between a part for the boundary line part of drawing 10, and the broken line of drawing 11), and in the interior of each part article (8' of drawing 10 and drawing 11, 9', 10') The technical problem that the cost which air clearance required for an insulation and the creeping distance on a printed circuit board are needed, and the whole equipment is enlarged as a result, and starts an insulation occurred mostly occurred. Moreover, a temperature detection means to detect the temperature of a compressor or an inverter similarly (since 12', and the compressor motor which serves as a candidate for detection also in 13' and the switching element itself of drawing 10 needed to insulate, the tooth space concerning an insulation and cost became large, or it was hard to install it in the latest, and it had the technical problem that a detection temperature error became large.)

[0013] Between two power circuits, although the insulation was carried out to the third, as shown in drawing 11, the noise by the switching which mainly serves as a noise source of AM band was easy to be guided with the stray capacity between circuits to the second electrical power system to it from the first electrical power system, and the problem of being easy to spread a noise to the inverter equipment exterior was in it. Moreover, similarly, the clock noise of the inverter control oriented microcomputer which mainly serves as a noise source of FM band was easy to be guided to the first electrical power system from the second electrical power system conversely, and had the problem of being easy to spread a noise to the inverter equipment exterior too. And from the power-source line influenced of these mutual noises, as shown in drawing 12, not only a conduction noise but the technical problem that it was easy to emit jamming to the body of radio or an antenna also as a radiated noise occurred.

[0014] that to which this invention solves such a conventional technical problem -- it is -- wiring -- being few -- small and low cost -- it is -- and electromagnetism -- it aims at offering few inverter

systems-for-air-conditioning-of-generating-of-a-noise.

[0015]

[Means for Solving the Problem] The electrically-driven compressor having the motor which drives this invention according to the (1) first power source in order to solve the above-mentioned technical problem, A compressor temperature detection means to detect the temperature of the coil part of the motor of said electrically-driven compressor in said first power system, The switching element group which transforms said first power source into the electrical potential difference for motorised [ said ] by the switching operation of two or more switching elements, Said switching element connected to either of the negative sides the forward side of said first power source The charge pump mold gate drive circuit driven using the power source which the current which flows to the switching element connected to a different polarity from the switching element concerned stored electricity, While outputting the control signal for turning on and turning off said switching element to said charge pump mold gate drive circuit and controlling said electrically-driven compressor It has the insulating communication circuit which communicates while insulating the control unit of the inverter control section which operates in said first power system, and the exterior which operates with the secondary insulation power source generated from said inverter control section and said first power source.

[0016] And since it is installing in the coil latest of the motor which the inverter system for air-conditioning of this invention makes a compressor temperature detection means the first power system by the above-mentioned configuration, and is connected to the same power system, the insulation between the different power sources of a detector and a detection object becomes unnecessary. Moreover, since it is installing in the motor-winding latest, temperature detection of an exact motor can be performed. Moreover, since all the circuits except a communication circuit with the exterior are operated by the first power system, the tooth space concerning the insulation between the different power sources on an inverter circuit and cost decrease.

[0017] (2) The electrically-driven compressor having the motor which it is carried in the car which has the first power source and second power source, and is driven according to said first power source, The switching element group which transforms said first power source into the electrical potential difference for motorised [ said ] by the switching operation of two or more switching elements, Said switching element connected to either of the negative sides the forward side of said first power source The charge pump mold gate drive circuit driven using the power source which the current which flows to the switching element connected to a different polarity from the switching element concerned stored electricity, While outputting the control signal for turning on and turning off said switching element to said charge pump mold gate drive circuit and controlling said electrically-driven compressor It has the insulating communication circuit which communicates while insulating the control unit of the inverter control section which operates in said first power system, and the exterior which operates in said inverter control section and said second power system.

[0018] And by the above-mentioned configuration, since the inverter system for air-conditioning of this invention is operating all the circuits except a communication circuit with the exterior by the first power system, it becomes unnecessary to draw the second power source in an inverter circuit, and it can reduce wiring. moreover, the electromagnetism between the first and the second power source -- the mutual intervention of a noise -- decreasing -- the electromagnetism to a car system -- a noise can be reduced.

[0019]

[Embodiment of the Invention] The electrically-driven compressor having the motor which drives invention according to claim 1 according to the first power source, A compressor temperature detection means to detect the temperature of the coil part of the motor of said electrically-driven compressor in said first power system, The switching element group which transforms said first power source into the electrical potential difference for motorised [ said ] by the switching operation of two or more switching elements, Said switching element connected to either of the negative sides the forward side of said first power source The charge pump mold gate drive circuit driven using the power source which the current which flows to the switching element connected to a different polarity from the switching element concerned stored electricity, While outputting the control signal for turning on and turning off said

switching element to said charge pump mold gate drive circuit and controlling said electrically-driven compressor. It has the insulating communication circuit which communicates while insulating the control unit of the inverter control section which operates in said first power system, and the exterior which operates with the secondary insulation power source generated from said inverter control section and said first power source.

[0020] And since it is installing in the coil latest of the motor which the inverter system for air-conditioning of this invention makes a compressor temperature detection means the first power system by the above-mentioned configuration, and is connected to the same power system, the insulation between the different power sources of a detector and a detection object becomes unnecessary. Moreover, since it is installing in the motor-winding latest, temperature detection of an exact motor can be performed. Moreover, since all the circuits except a communication circuit with the exterior are operated by the first power system, the tooth space concerning the insulation between the different power sources on an inverter circuit and cost decrease.

[0021] The electrically-driven compressor having the motor which invention according to claim 2 is carried in the car which has the first power source and second power source, and is driven according to said first power source. The switching element group which transforms said first power source into the electrical potential difference for motorised [ said ] by the switching operation of two or more switching elements, Said switching element connected to either of the negative sides the forward side of said first power source. The charge pump mold gate drive circuit driven using the power source which the current which flows to the switching element connected to a different polarity from the switching element concerned stored electricity, While outputting the control signal for turning on and turning off said switching element to said charge pump mold gate drive circuit and controlling said electrically-driven compressor. It has the insulating communication circuit which communicates while insulating the control unit of the inverter control section which operates in said first power system, and the exterior which operates in said inverter control section and said second power system.

[0022] And by the above-mentioned configuration, since the inverter system for air-conditioning of this invention is operating all the circuits except a communication circuit with the exterior by the first power system, it becomes unnecessary to draw the second power source in an inverter circuit, and it can reduce wiring. moreover, the electromagnetism between the first on a circuit, and the second power source -- the mutual intervention of a noise -- decreasing -- the electromagnetism to a car system -- a noise can be reduced.

[0023] Invention according to claim 3 is added to the configuration of claim 2, and establishes a compressor temperature detection means to detect the temperature of the coil part of a motor in the first power system.

[0024] Invention according to claim 4 equips claims 2 and 3 with the configuration of a publication, when the first power source and second power source are insulated.

[0025] And since the inverter system for air-conditioning of this invention is operating all the circuits except a communication circuit with the exterior by the first power system by the above-mentioned configuration, the tooth space concerning the insulation between the different power sources on an inverter circuit and cost decrease. moreover, the electromagnetism the stray capacity between the first and the second power source becomes less, and according to it -- the mutual intervention of a noise -- decreasing -- the electromagnetism to a car system -- a noise can be reduced.

[0026] Invention according to claim 5 equips claims 2 and 3 with the configuration of a publication, when the first power source and second power source are insulated and the second power source is grounded to the car case.

[0027] And since the inverter system for air-conditioning of this invention is operating all the circuits except a communication circuit with the exterior by the first power system by the above-mentioned configuration, electromagnetic wave active jamming to mounted devices, such as mounted radio with which the second power source especially serves as a case ground, can be lessened.

[0028]

[Example] Hereafter, it explains, referring to a drawing about the example of this invention. In addition,

~~explanation is omitted about the part which overlaps the contents explained in the conventional example.~~

[0029] Drawing 1 is the electrical diagram of the inverter system for air-conditioning of one example of this invention, and, as for it, differing greatly with the configuration of drawing 3 of this drawing 1 and the conventional example is the point that inverter equipment 1 operates with the power source only from the main cell 2, in this invention of drawing 1. In order to realize this, the gate drive circuit 9 of a charge pump mold is used for this invention that the insulation between the inverter control oriented microcomputer 7 and the switching element group 4 should be first made unnecessary.

[0030] This charge pump type of gate drive circuit is explained using drawing 5 below. Drawing 5 is the circuit diagram for 1 block of this charge pump mold gate drive circuit, and drawing 13 is the conventional circuit diagram. In drawing 5, the power source of the inverter control oriented microcomputer 7 is taken from the negative terminal (H-) of the main cell, and the positive terminal (H+) of the main cell. However, since a positive terminal is an about [ DC250V ] high voltage, the about [ 5V ] electrical potential difference decompresses through resistance and zener diode. And ON of IGBT 27 and 28 and an off signal are outputted to the gate drive circuit from this microcomputer 7. Moreover, power-source 2' for a gate drive is the DC power supply which make a negative terminal equal to the negative terminal of the main cell, and this is built inside inverter equipment 1 by the power source from the main cell. 24 is the amplifier which changes the control signal from a microcomputer 7 into an IGBT driving signal, and 25 is a solid state switch circuit (for example, MOS-FET circuit) of high pressure-proofing which transmits the control signal by the side of forward to the amplifier 24 by the side of forward.

[0031] Next, actuation is explained. First, about the negative side IGBT28, the control signal of the ON from a microcomputer 7 and OFF (for example, 5V, 0V) is changed into ON of IGBT, and off level (for example, 15V, 0V) by the negative side amplifier 24, and is driving IGBT28 with it. Next, about the forward side IGBT, while the negative side IGBT28 turns on, a current flows from power-source 2' through diode 29 to a capacitor 30, IGBT28, and a power-source 2' negative terminal, and a capacitor 30 is charged. Moreover, the charge electrical potential difference of this capacitor 30 is supplied to the forward side amplifier 24 as a power source. And the ON from a microcomputer 7 and an off control signal (5V, 0V) are changed into the electrical potential difference (15V, 0V) on the basis of EMMITA of IGBT27 by the solid state switch circuit 25 and amplifier 24 of high pressure-proofing, and drive IGBT27 with them. And by using this charge pump mold gate drive circuit, the power source to which a power system differs from 3' of the conventional gate drive circuit ( drawing 13 ) and the main cell as shown in 31 becomes unnecessary, and the control drive of the IGBT can be carried out in a single power system.

[0032] In drawing 1, it is using a charge pump mold gate drive circuit, and the inverter system of most centering on a microcomputer 7 consists of power systems of the main cell 2 so that the above explanation may show. The b side of the boundary line shown by \*\*\*\*\* of drawing 1 is the power system of the main cell. And by this, in each circuit of the charge circuit 11 which needed the insulation between different power sources, the current detecting element 8, the gate drive circuit 9, and induced voltage detecting-element 10 grade, the need for an insulation is lost and small [ large ] and low cost-ization can be carried out conventionally. The example is explained below.

[0033] Drawing 6 is what showed the example of a relay of a charge circuit, the relay for which the distance for insulation between different power sources was required becomes unnecessary [ the distance for insulation ], as are conventionally shown in drawing 14 and is shown in drawing 6 (a) and (b), and it becomes possible [ also reducing wiring, as shown in drawing 6 (b) ].

[0034] Drawing 7 is what showed the example of a current detecting element, and as conventionally shown in drawing 14, what has the required photo coupler 26 becomes unnecessary in drawing 7 of this invention between the shunt resistance 19 and a microcomputer.

[0035] Although drawing 8 was what showed the example of an induced voltage detecting element, and the CR filter, the comparator, and the photo coupler 26 were required for it as conventionally shown in drawing 16, it becomes possible to input into a direct microcomputer only by pressuring partially, as



~~this invention is shown in drawing 8.~~

[0036] Although drawing 5 was what showed the case of the gate drive circuit mentioned above, and a photo coupler 26, power-source 3', and 31 were required for it as conventionally shown in drawing 13, in this invention, it becomes unnecessary. Moreover, the power source which is equivalent to 31 about other 2 blocks becomes unnecessary.

[0037] Moreover, although the detail circuit is omitted, the power circuit 6 shown in conventional drawing 2 also becomes unnecessary.

[0038] Moreover, drawing 3 was what showed the example of the miniaturization of a printed circuit board which mounted these components and a circuit, as conventionally shown in drawing 11, it needed the insulation between different power sources, but if it removes the insulating communication circuit 20 in the printed circuit board of this invention, it becomes unnecessary. Moreover, the miniaturization of each part article and a circuit also laps and it succeeds in the large miniaturization by the whole printed circuit board.

[0039] Although drawing 9 was what showed the circuit diagram of the insulating communication circuit 20 for which only the insulation between different electrical power systems is needed in the inverter equipment 1 of this invention and especially the insulation had unnecessary drawing 16 in the conventional circuit, an insulation is needed as this invention is shown in drawing 9. However, synthetically, it is clear that this invention can attain small and low cost-ization from the above-mentioned explanation.

[0040] Next, the inverter temperature detection means 12 and the compressor temperature detection means 13 in drawing 1 are explained.

[0041] Conventionally, these temperature detection means were installed electrically to the case part in many cases. For example, the inverter temperature detection means is installed in the heat sink for heat dissipation, in order to detect the temperature of a switching element, and the compressor temperature detection means was installed in the body of a compressor. And the body of these heat sinks and compressors was electrically connected to the case of a car. Therefore, it was disadvantageous to have operated these detectors in this invention by the power system of the main cell [ high voltage as it is ] 2 in respect of insulating strengthening with a case and the main cell. That is, I hear that high voltage main cell and case will approach physically, and there are. Then, in this invention, the inverter temperature detection means 12 is installed in the interior of the switching element 4 which is operating by the main cell, and the compressor temperature detection means 13 is installed in motor winding which is operating by the main cell too. And it enables it to detect more exact temperature by carrying out like this, securing safety equivalent to the former.

[0042] Moreover, in this invention, the following thing is similarly performed from consideration of a safety aspect. He packs wiring of the power system of the main cell which will newly be left from inverter equipment 1 to the exterior, i.e., wiring for the compressor temperature detection means 13 and wiring to a charge circuit 11, into wiring of the three-phase-circuit output to an electrically-driven compressor 5, and wiring of the power-source input from the main cell, respectively, and is trying to take about the inside of a car case in drawing 1. He covers with a protective tubing common concrete respectively, and is trying to take about it. By carrying out like this, there is completely no difference between the former and an insurance top.

[0043] next, this invention -- electromagnetism -- the good effect done to a noise is explained using drawing 4. Drawing 4 shows the example of loading to the electric vehicle of this invention, from the car case 32, floating of the main cell 2 is usually carried out, and the auxiliary cell 3 is grounded to the car case 32. And the mounted radio 33 and the mounted device of air-conditioning control-section 14 grade are operating considering an auxiliary cell as a power source. Moreover, 34 is the receiving antenna of radio and the earth terminal is connected to the case 32. And the inverter equipment 1 of this invention has received supply of a power source only from the main cell 2, and it insulates in the air-conditioning control section 14, and it is communicating.

[0044] And in the configuration of this above mentioned this invention, since the power-source line from the auxiliary cell 3 is not drawn in inverter equipment 1, the stray capacity between each power

source on a printed circuit board becomes less, the noise generated from inverter equipment 1 cannot spread the electric-wire top concerned easily, and the conduction noise to the power system of an auxiliary cell is reduced. Moreover, conventionally, the radiated noise was generated from the power-source line of an auxiliary cell by this conduction noise, and this radiated noise can also be reduced in this invention.

[0045] Next, the conduction noise to the power-source line of the main cell 2 and the radiated noise by it have the features that a cure is easy, in this invention, although there are not the former and a change in the inverter system of drawing 1. It is because a cure can be managed with the former as one cure in this invention in a required place about two power sources.

[0046] Drawing 2 is the electrical diagram of the inverter system of this invention also including the cure against a noise to the power-source line of this main cell. This inverter equipment 1" incorporates noise filters 22 and 23 and a charge circuit 11 to the tooth space conventionally miniaturized from elegance. Both the inverter noise by switching and the clock noise of a microcomputer are removable by arranging these noise filters 22 and 23 like drawing 2 with a common noise filter.

[0047] Moreover, the inverter system of drawing 2 is equipped also with the electrical-potential-difference detector 21 for the function and the engine-performance rise. With the conventional configuration, in this invention, it can realize easily and this circuit is installed by pressuring partially and carrying out a direct input to a microcomputer, although it was very difficult to insulate and to detect an electrical potential difference with a sufficient precision.

[0048]

[Effect of the Invention] So that clearly from said example invention according to claim 1 The electrically-driven compressor having the motor driven according to the first power source, and a compressor temperature detection means to detect the temperature of the coil part of the motor of said electrically-driven compressor in said first power system, The switching element group which transforms said first power source into the electrical potential difference for motorised [ said ] by the switching operation of two or more switching elements, Said switching element connected to either of the negative sides the forward side of said first power source The charge pump mold gate drive circuit driven using the power source which the current which flows to the switching element connected to a different polarity from the switching element concerned stored electricity, While outputting the control signal for turning on and turning off said switching element to said charge pump mold gate drive circuit and controlling said electrically-driven compressor Since it has the insulating communication circuit which communicates while insulating the control unit of the inverter control section which operates in said first power system, and the exterior which operates with the secondary insulation power source generated from said inverter control section and said first power source Most inverter systems can be operated in the first single power system, and the tooth space and cost concerning the insulation between the different power sources on a system can be lessened. Moreover, safety is secured by installing a compressor temperature detection means in the coil latest of a motor, and exact temperature detection also becomes possible.

[0049] The electrically-driven compressor having the motor which invention according to claim 2 is carried in the car which has the first power source and second power source, and is driven according to said first power source, The switching element group which transforms said first power source into the electrical potential difference for motorised [ said ] by the switching operation of two or more switching elements, Said switching element connected to either of the negative sides the forward side of said first power source The charge pump mold gate drive circuit driven using the power source which the current which flows to the switching element connected to a different polarity from the switching element concerned stored electricity, While outputting the control signal for turning on and turning off said switching element to said charge pump mold gate drive circuit and controlling said electrically-driven compressor Since it has the insulating communication circuit which communicates while insulating the control unit of the inverter control section which operates in said first power system, and the exterior which operates in said inverter control section and said second power system It becomes unnecessary to be able to operate most inverter systems in the first single power system, and to draw the second power

source in an inverter circuit, and wiring can be reduced. moreover, the electromagnetism between the first on a circuit, and the second power source -- the mutual intervention of a noise -- decreasing -- the electromagnetism to a car system -- a cure also becomes easy at the same time it reduces a noise.

[0050] Since invention according to claim 4 equips claims 2 and 3 with the configuration of a publication when the first power source and second power source are insulated, it can lessen the tooth space and cost concerning the insulation between different power sources in the inverter system which has the power system concerned. moreover, the electromagnetism the stray capacity between the first on a circuit and the second power source becomes less, and according to it -- the mutual intervention of a noise -- decreasing -- the electromagnetism to a car system -- a noise can be reduced.

[0051] Since invention according to claim 5 equips claims 2 and 3 with the configuration of a publication when the first power source and second power source are insulated and the second power source is grounded to the car case, it can lessen electromagnetic wave active jamming to mounted devices, such as mounted radio with which the second power source serves as a case ground, in the inverter system which has the power system concerned.

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[Translation done.]

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**DESCRIPTION OF DRAWINGS**

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**[Brief Description of the Drawings]**

- [Drawing 1] The inverter structure-of-a-system Fig. for air-conditioning showing one example of this invention
- [Drawing 2] The inverter structure-of-a-system Fig. for air-conditioning showing the same example
- [Drawing 3] The block diagram of the printed circuit board of the inverter equipment in this invention
- [Drawing 4] The loading block diagram to the electric vehicle of the inverter system for air-conditioning of this invention
- [Drawing 5] The block diagram of a charge pump mold gate drive circuit
- [Drawing 6] (a) The block diagram of the charge circuit in this invention  
(b) The block diagram of the charge circuit in this invention
- [Drawing 7] The block diagram of the current detecting element of this invention
- [Drawing 8] The block diagram of the induced voltage detecting element of this invention
- [Drawing 9] The block diagram of the communication circuit in this invention
- [Drawing 10] The conventional inverter structure-of-a-system Fig. for air-conditioning
- [Drawing 11] The block diagram of the printed circuit board of the inverter equipment in the former
- [Drawing 12] The loading block diagram to the electric vehicle of the conventional inverter system for air-conditioning
- [Drawing 13] The block diagram of the conventional general gate drive circuit
- [Drawing 14] The block diagram of the conventional charge circuit
- [Drawing 15] The block diagram of the conventional current detecting element
- [Drawing 16] The block diagram of the conventional induced voltage detecting element
- [Drawing 17] The block diagram of the communication circuit in the former

**[Description of Notations]**

- 1 Inverter Equipment 1
- 1' Inverter equipment 2
- 1" Inverter equipment 3
- 2 The Main Cell
- 2' Power source 1
- 3 Auxiliary Cell
- 4 Switching Element Group
- 5 Electrically-driven Compressor
- 6 Power Circuit
- 7 Inverter Control Oriented Microcomputer 1
- 7' Inverter control oriented microcomputer 2
- 8 Current Detecting Element 1
- 8' Current detecting element 2
- 9 Gate Drive Circuit 1
- 9' Gate drive circuit 2

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10 Induced Voltage Detecting Element 1  
10' Induced voltage detecting element 2  
11 Charge Circuit 1  
11' Charge circuit 2  
12 Inverter Temperature Detection Means 1  
12' Inverter temperature detection means 2  
13 Compressor Temperature Detection Means 1  
13' Compressor temperature detection means 2  
14 Air-conditioning Control Section  
15 Source Power Supply  
16 Rectifier Diode  
17 Isolation Transformer  
18 Electrolytic Capacitor 1  
19 Shunt Resistance  
20 Insulating Communication Circuit  
21 Electrical-Potential-Difference Detecting Element  
22 Noise Filter 1  
23 Noise Filter 2  
24 Amplifier  
25 High Proof-Pressure Solid State Switch Circuit  
26 Photo Coupler  
27 Forward Side IGBT  
28 Negative Side IGBT  
29 Zener Diode  
30 Electrolytic Capacitor 2  
31 Power Source 2  
32 Car Case  
33 Mounted Radio  
34 Antenna

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[Translation done.]

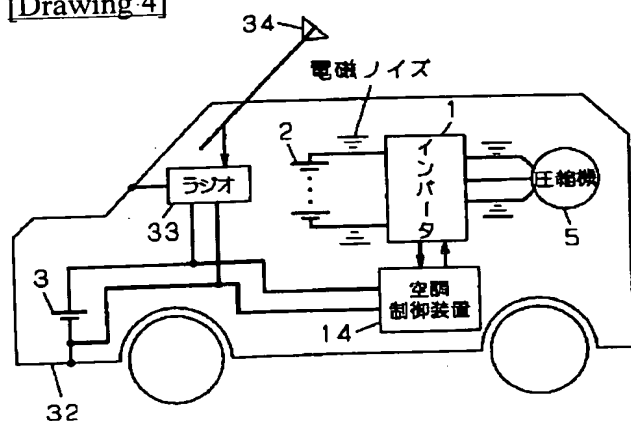
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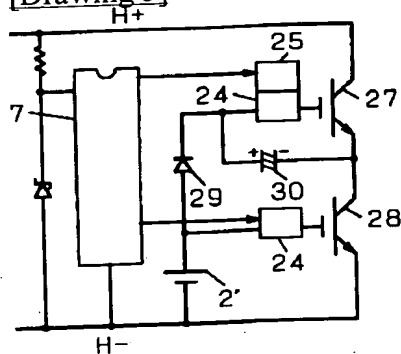
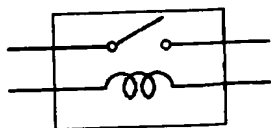
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3. In the drawings, any words are not translated.

## DRAWINGS

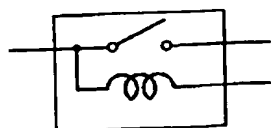
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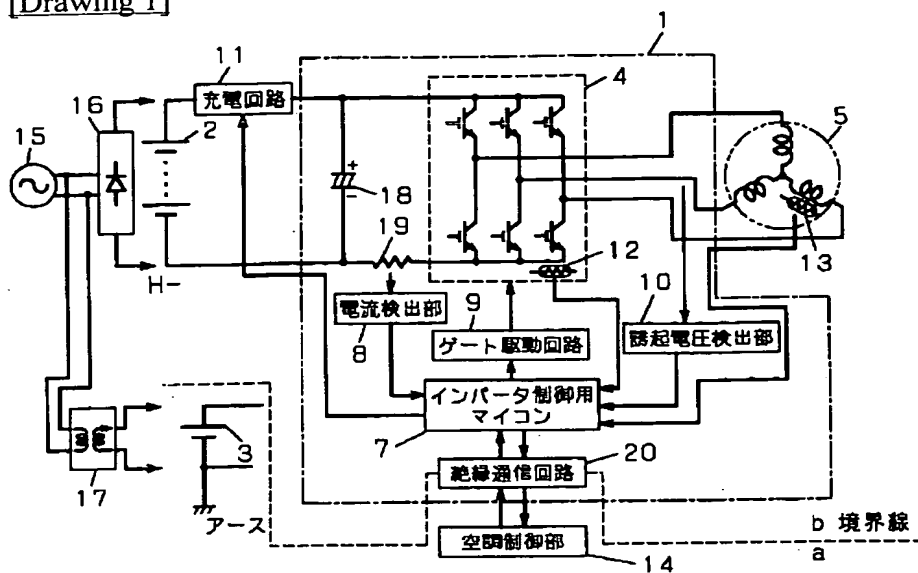
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[Drawing 6]  
(a)

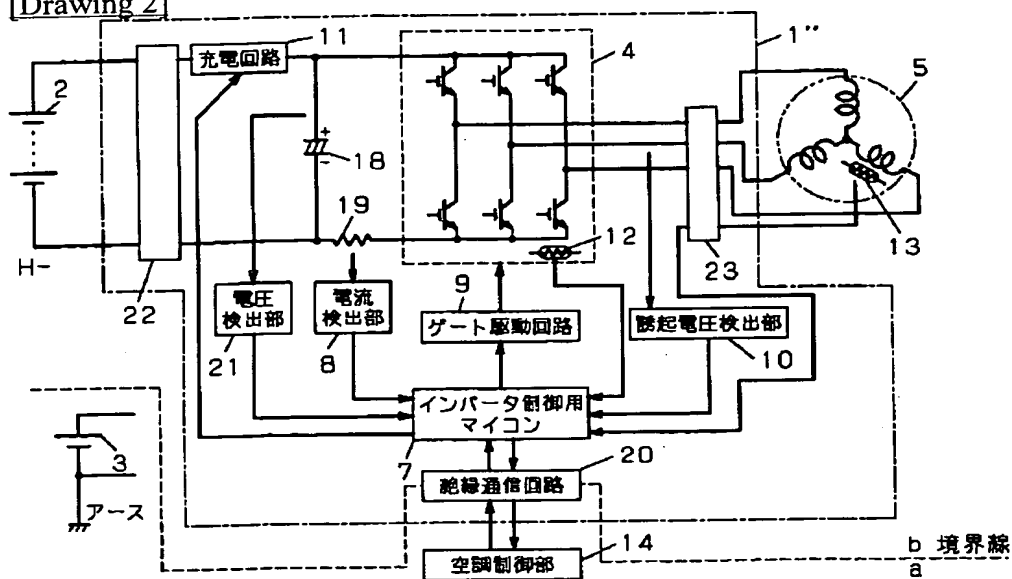
(b)



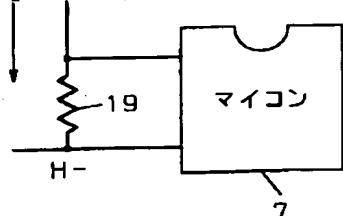
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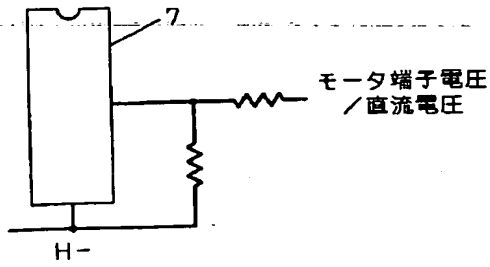
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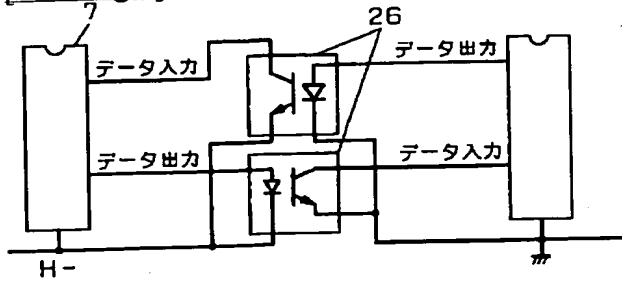
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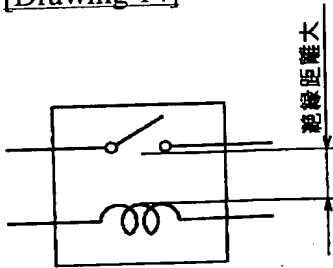
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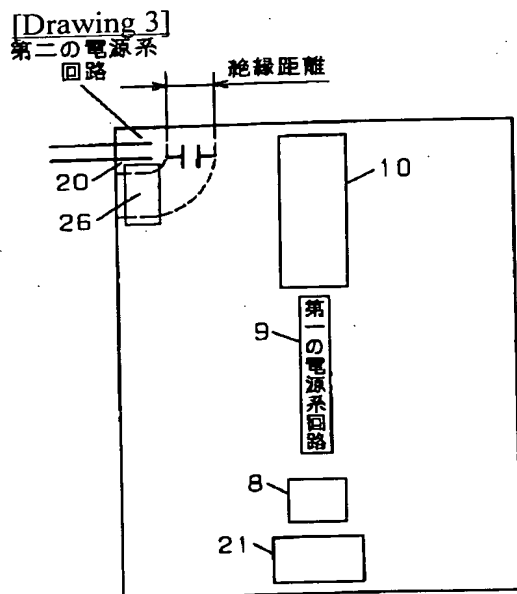
[Drawing 9]



[Drawing 14]

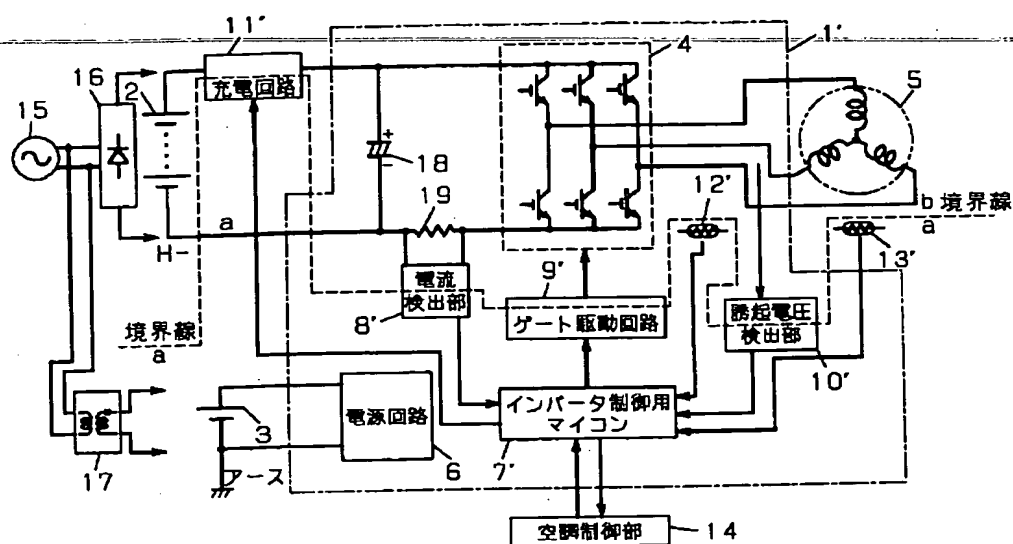


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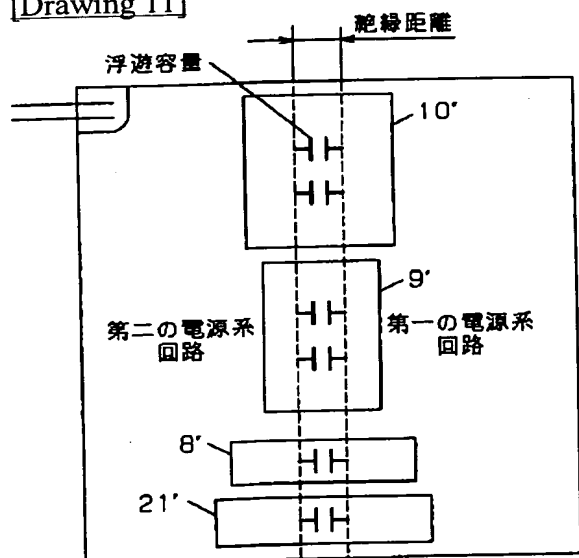


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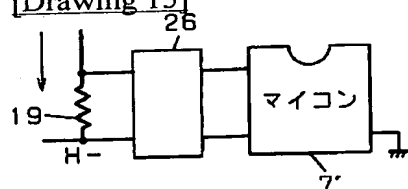




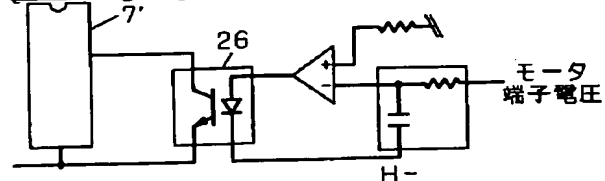
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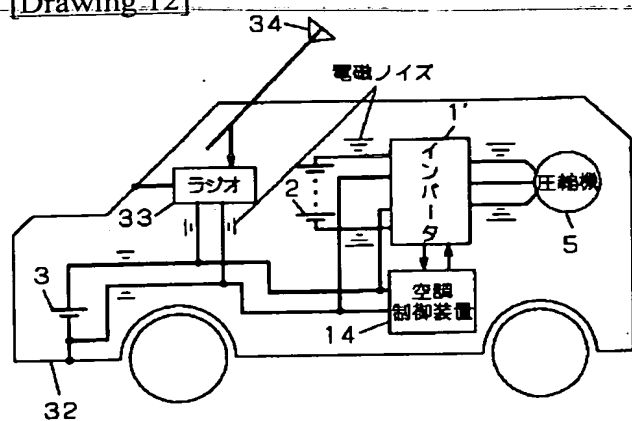
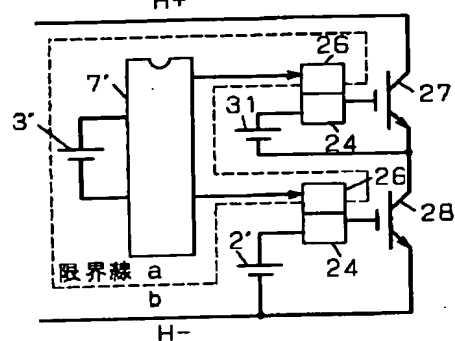
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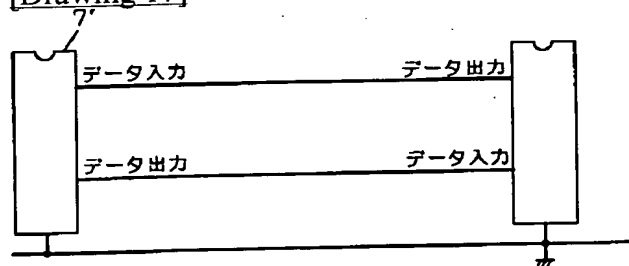
[Drawing 16]



[Drawing 12]

[Drawing 13]  
H+

[Drawing 17]



[Translation done.]

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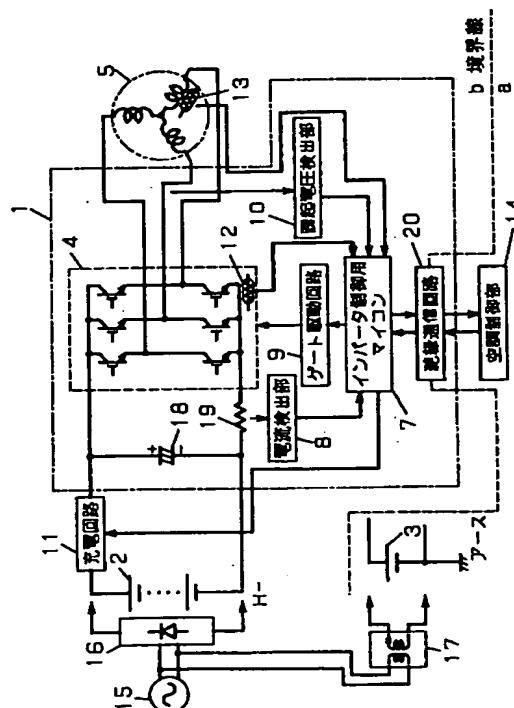
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(54) 【発明の名称】 空調用インバータシステム

(57) 【要約】

【課題】 空調用インバータシステムの省線化、小型化、軽量化、低コスト化と電磁ノイズの低減を図る。

【解決手段】 主電池2の電源系統（第一の電源系統）にて動作するチャージポンプ型ゲート駆動回路9と、モータ巻線に配置された圧縮機温度検出手段13と、インバータ制御用マイコン7と、外部の空調制御部14と絶縁しながら通信する絶縁通信回路を設けた。これによって、インバータシステムの大部分を単一の電源系にて動作させ、電磁ノイズの低減と、異電源間の絶縁に係るスペース、コストを低減し、かつ配線も減らすことができる。



置の場合には、電源は単相100V等の商用電源15から供給されており一次電源としてはこの商用電源15だけである。そして圧縮機の駆動電源としては、それを整流ダイオード16にて整流した直流電源がやはりスイッチング素子群4を介して電動圧縮機5へと供給されている。

【0009】次に制御系への電源としては、商用電源15を絶縁トランス17にて減圧かつ絶縁した2次絶縁直流電圧が、インバータ制御用マイコン7'や空調制御部14等の電源として供給されている。この絶縁トランス17を用いた電源回路は、図示はしていないが通常インバータ装置1'内に組み込まれている。また電流検出部8'やゲート駆動回路9'、誘起電圧検出部10'は、前述した電気自動車用の場合と同様に高電圧な駆動系の電源と、その駆動系電源からは絶縁された低電圧な電源(2次絶縁直流電源)からの両方の電源系で動作している回路である。

【0010】

【発明が解決しようとする課題】しかしながら、前述の従来のインバータシステムにおいては、以下に示すような課題があった。

【0011】第一に、インバータ装置1'へは2系統の電源を引き込む必要があり、配線が増えるという課題があった。

【0012】第二に、2系統の絶縁が必要な電源を、インバータ装置1'内に引き込んでいるので、それぞれの電源で動作している各回路間(図10の境界線部分、図11の破線間)や、各部品(図10と図11の8', 9', 10')の内部においては、絶縁のために必要な空間距離や、プリント基板上での沿面距離が必要となり、結果として装置全体が大型化し、かつ絶縁に係るコストが多く発生するという課題があった。また同様に、圧縮機やインバータの温度を検出する温度検出手段(図10の12', 13')においても、検出対象となる圧縮機モータやスイッチング素子そのものとは、絶縁する必要があるため、絶縁に係るスペース、コストが大きくなるか、もしくは直近に設置しにくく、検出温度誤差が大きくなるという課題があった。

【0013】第三に、2系統の電源回路間は絶縁はされているものの、図11に示すように回路間の浮遊容量によって、主にAM帯のノイズ源となっているスイッチングによるノイズが、第一の電源系から第二の電源系へ誘導されやすく、インバータ装置外部へノイズが伝播しやすいという問題があった。また同様に、主にFM帯のノイズ源となっているインバータ制御用マイコンのクロックノイズは、逆に第二の電源系から第一の電源系へ誘導されやすく、やはりインバータ装置外部へノイズが伝播しやすいという問題があった。そして、これら互いのノイズの影響を受けた電源線からは図12に示すように伝導ノイズのみならず、放射ノイズとしてもラジオ本体や

アンテナへ妨害電波を発生しやすいという課題があった。

【0014】本発明は、このような従来の課題を解決するものであり、配線が少なく、小型、低コストで、かつ電磁ノイズの発生が少ない空調用インバータシステムを提供することを目的としている。

【0015】

【課題を解決するための手段】上記課題を解決するために本発明は、(1)第一の電源によって駆動されるモータを内蔵した電動圧縮機と、前記電動圧縮機のモータの巻線部分の温度を前記第一の電源系統にて検出する圧縮機温度検出手段と、前記第一の電源を複数のスイッチング素子のスイッチング動作によって前記モータ駆動用の電圧に変換するスイッチング素子群と、前記第一の電源の正側、負側いずれかに接続された前記スイッチング素子を、当該スイッチング素子とは異なる極性に接続されたスイッチング素子に流れる電流によって蓄電された電源を用いて駆動するチャージポンプ型ゲート駆動回路と、前記チャージポンプ型ゲート駆動回路へ前記スイッチング素子をオン、オフするための制御信号を出力して前記電動圧縮機を制御するとともに、前記第一の電源系統にて動作するインバータ制御部と、前記インバータ制御部と前記第一の電源から生成される二次絶縁電源にて動作する外部の制御装置とを絶縁しながら通信する絶縁通信回路を備えたものである。

【0016】そして上記した構成により本発明の空調用インバータシステムは、圧縮機温度検出手段を第一の電源系統とし、かつ同一電源系統に接続されているモータの巻線直近に設置しているので、検出器と検出対象物の異電源間の絶縁が不要となる。またモータ巻線直近に設置しているので正確なモータの温度検出ができる。また、外部との通信回路を除くすべての回路を、第一の電源系統で動作させているので、インバータ回路上の異電源間の絶縁に係るスペース、コストが少なくなる。

【0017】(2)第一の電源と第二の電源とを有する車両に搭載され、前記第一の電源によって駆動されるモータを内蔵した電動圧縮機と、前記第一の電源を複数のスイッチング素子のスイッチング動作によって前記モータ駆動用の電圧に変換するスイッチング素子群と、前記第一の電源の正側、負側いずれかに接続された前記スイッチング素子を、当該スイッチング素子とは異なる極性に接続されたスイッチング素子に流れる電流によって蓄電された電源を用いて駆動するチャージポンプ型ゲート駆動回路と、前記チャージポンプ型ゲート駆動回路へ前記スイッチング素子をオン、オフするための制御信号を出力して前記電動圧縮機を制御するとともに、前記第一の電源系統にて動作するインバータ制御部と、前記インバータ制御部と前記第二の電源系統にて動作する外部の制御装置とを絶縁しながら通信する絶縁通信回路を備えたものである。

【0018】そして上記した構成により本発明の空調用

GBT 27, 28のオン、オフ信号が出力されている。またゲート駆動用電源2'は、負端子を、主電池の負端子と等しくする直流電源で、これは主電池からの電源によってインバータ装置1の内部でつくられている。24はマイコン7からの制御信号を、IGBT駆動信号に変換する増幅器で、25は正側の制御信号を正側の増幅器24へ伝達する高耐圧の半導体スイッチ回路(例えばMOS-FET回路)である。

【0031】次に動作について説明する。まず負側IGBT 28については、マイコン7からのオン、オフ(例えば5V, 0V)の制御信号が、負側増幅器24によってIGBTのオン、オフレベル(例えば15V, 0V)へ変換されてIGBT 28を駆動している。次に正側IGBTについては、負側IGBT 28がオンしている間に、電源2'からダイオード29を通してコンデンサ30、IGBT 28、電源2'負端子へと電流が流れて、コンデンサ30が充電される。またこのコンデンサ30の充電電圧が電源として正側増幅器24へ供給されている。そしてマイコン7からのオン、オフの制御信号(5V, 0V)が高耐圧の半導体スイッチ回路25と増幅器24によって、IGBT 27のエミタを基準とする電圧(15V, 0V)へ変換されて、IGBT 27を駆動する。そしてこのチャージポンプ型ゲート駆動回路を用いることで、従来のゲート駆動回路(図13)の3', 31に示すような、主電池とは電源系統の異なる電源が不要となり、単一の電源系統にてIGBTを制御駆動することができる。

【0032】以上の説明からわかるように、図1においては、チャージポンプ型ゲート駆動回路を用いることで、マイコン7を中心とした大部分のインバータシステムを主電池2の電源系統にて構成している。図1の太破線で示された境界線のb側が主電池の電源系統である。そしてこのことによって、従来、異電源間の絶縁が必要であった充電回路11、電流検出部8、ゲート駆動回路9、誘起電圧検出部10等の各回路においては、絶縁の必要がなくなり大幅な小型、低コスト化をすることができる。以下その一例について説明する。

【0033】図6は充電回路のリレーの例を示したもので、従来図14に示されるように異電源間の絶縁距離が必要であったリレーが、図6(a), (b)に示されるように、絶縁距離が不要となり、また図6(b)に示されるように配線を減らすことも可能となる。

【0034】図7は電流検出部の例を示したもので、従来図14に示すようにシャント抵抗19とマイコン間でフォトカプラ26が必要であったものが本発明の図7においては不要となる。

【0035】図8は誘起電圧検出部の例を示したもので、従来図16に示すようにCRフィルター、コンパレータ、フォトカプラ26が必要であったが、本発明においては図8に示すごとく分圧するだけで直接マイコンに

入力することが可能となる。

【0036】図5は前述したゲート駆動回路の場合を示したもので、従来図13に示すようにフォトカプラ26や電源3', 31が必要であったが、本発明においては不要となる。また他の2ブロックについても31に相当する電源が不要となる。

【0037】また詳細回路は省略してあるが、従来の図2に示した電源回路6も不要となる。

【0038】また図3は、これらの部品、回路を実装したプリント基板の小型化の例を示したもので、従来は図11に示すように異電源間の絶縁が必要であったが、本発明のプリント基板においては絶縁通信回路20を除いては不要となる。また各部品、回路の小型化も重なりプリント基板全体で大幅な小型化が為されている。

【0039】図9は、本発明のインバータ装置1において唯一、異電源系間の絶縁が必要となる絶縁通信回路20の回路図を示したもので、図16が従来の回路で特に絶縁は必要なかったが、本発明においては図9に示すごとく絶縁が必要となる。しかし総合的には、上記説明より本発明の方が小型、低コスト化が図れるのは明白である。

【0040】次に、図1におけるインバータ温度検出手段12と圧縮機温度検出手段13について説明する。

【0041】従来、これらの温度検出手段は、電気的に筐体部分へ設置される場合が多かった。例えばインバータ温度検出手段はスイッチング素子の温度を検出するために放熱用ヒートシンクに設置されており、また圧縮機温度検出手段は圧縮機のボディーに設置されていた。そしてこれらのヒートシンクや圧縮機のボディーは、車両の筐体に電気的に接続されていた。従って、本発明においてこれらの検出器をそのまま高電圧な主電池2の電源系統で動作させることは、筐体と主電池との絶縁強化の面では不利であった。つまり高電圧な主電池と筐体とが物理的に近接してしまうということである。そこで本発明においては、インバータ温度検出手段12は、主電池で動作しているスイッチング素子4の内部に設置し、また圧縮機温度検出手段13は、やはり主電池で動作しているモータ巻線に設置している。そしてこうすることで、従来と同等の安全性を確保しながら、かつより正確な温度が検出できるようにしている。

【0042】また同様に安全面への配慮から、本発明においては次のことを行っている。図1において、インバータ装置1から新たに外部へ出て行くことになる主電池の電源系統の配線、つまり圧縮機温度検出手段13への配線と充電回路11への配線は、それぞれ電動圧縮機5への3相出力の配線と主電池からの電源入力配線の中にまとめて、車両筐体内を引き回すようにしている。具体的には、それぞれ共通の保護チューブにて覆い、それを引き回すようにしている。こうすることで、安全上は従来と全く変わりがない。

ラジオ等の車載機器への電磁波妨害を少なくすることができる。

【図面の簡単な説明】

【図1】本発明の一実施例を示す空調用インバータシステムの構成図

【図2】同一実施例を示す空調用インバータシステムの構成図

【図3】本発明におけるインバータ装置のプリント基板の構成図

【図4】本発明の空調用インバータシステムの電気自動車への搭載構成図

【図5】チャージポンプ型ゲート駆動回路の構成図

【図6】(a) 本発明における充電回路の構成図

(b) 本発明における充電回路の構成図

【図7】本発明の電流検出部の構成図

【図8】本発明の誘起電圧検出部の構成図

【図9】本発明における通信回路の構成図

【図10】従来の空調用インバータシステムの構成図

【図11】従来におけるインバータ装置のプリント基板の構成図

【図12】従来の空調用インバータシステムの電気自動車への搭載構成図

【図13】従来的一般的ゲート駆動回路の構成図

【図14】従来の充電回路の構成図

【図15】従来の電流検出部の構成図

【図16】従来の誘起電圧検出部の構成図

【図17】従来における通信回路の構成図

【符号の説明】

1 インバータ装置 1

1' インバータ装置 2

1'' インバータ装置 3

2 主電池

2' 電源 1

3 補助電池

4 スwitching素子群

5 電動圧縮機

6 電源回路

7 インバータ制御用マイコン 1

7' インバータ制御用マイコン 2

8 電流検出部 1

8' 電流検出部 2

9 ゲート駆動回路 1

9' ゲート駆動回路 2

10 誘起電圧検出部 1

10' 誘起電圧検出部 2

11 充電回路 1

11' 充電回路 2

12 インバータ温度検出手段 1

12' インバータ温度検出手段 2

13 圧縮機温度検出手段 1

13' 圧縮機温度検出手段 2

14 空調制御部

15 商用電源

16 整流ダイオード

17 絶縁トランス

18 電解コンデンサ 1

19 シャント抵抗

20 絶縁通信回路

21 電圧検出部

22 ノイズフィルター 1

23 ノイズフィルター 2

24 増幅器

25 高耐圧半導体スイッチ回路

26 フォトカプラ

27 正側 IGBT

28 負側 IGBT

29 ツェナーダイオード

30 電解コンデンサ 2

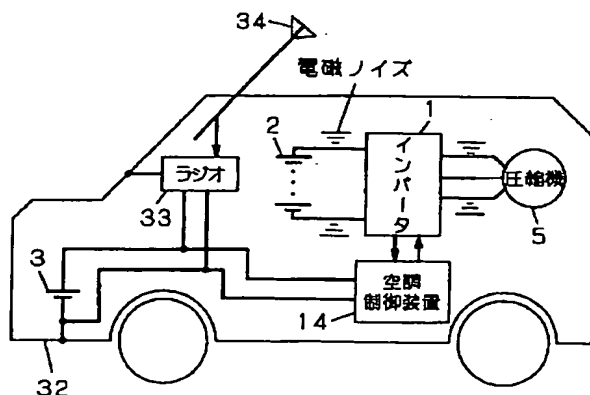
31 電源 2

32 車両筐体

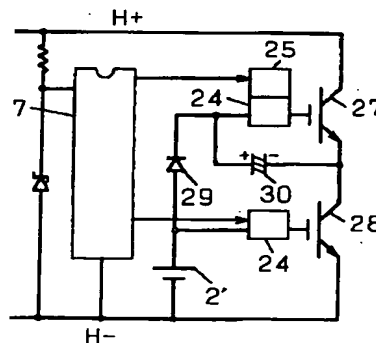
33 車載ラジオ

34 アンテナ

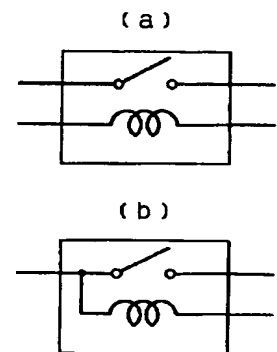
【図4】



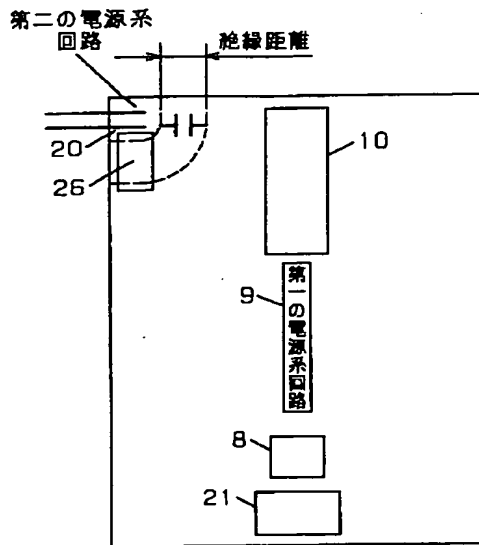
【図5】



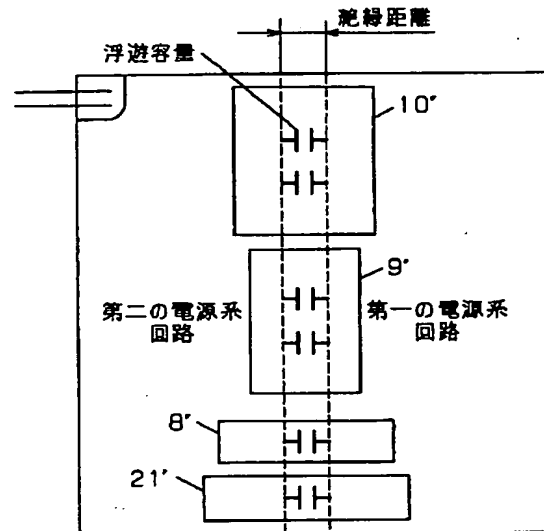
【図6】



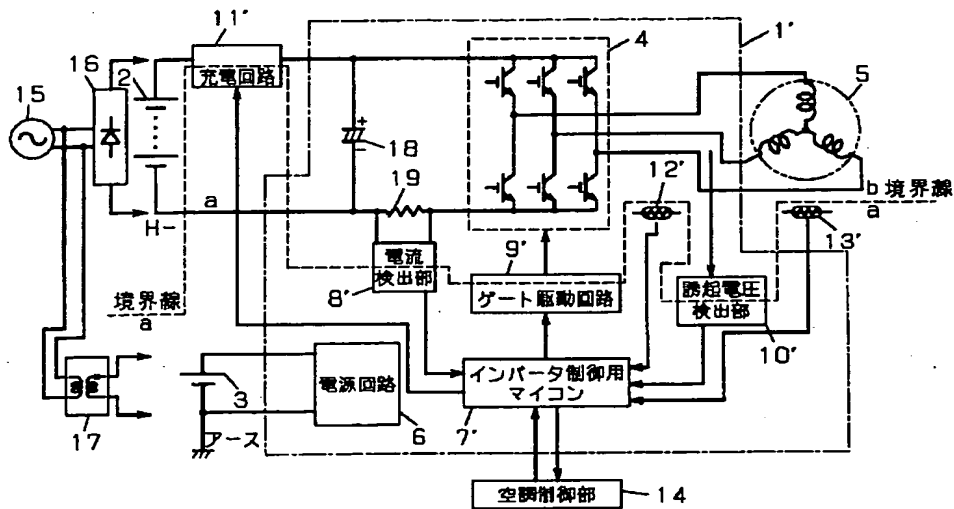
【図 3】



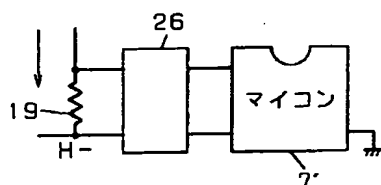
【図 11】



【図 10】



【図 15】



【図 16】

